The Main-belt Asteroid and NEO Tour with Imaging and Spectroscopy (MANTIS). A. S. Rivkin[1], B. A. Cohen[2], O. Barnouin[1], C. M. Ernst[1], N. L. Chabot[1], B. W. Denevi[1], B. T. Greenhagen[1], R. L. Klima[1], M. Perry[1], Z. Sternovsky[3] and the MANTIS Science Team[4]. [1]JHU/APL, [2]NASA GSFC, [3]U. Colorado, [4]Various.

While the overwhelming numbers of small bodies makes the prospects of visiting a representative sample of asteroids daunting, recent work suggests that the vast majority of objects in the asteroid belt may be derived from a small number of 100-km-scale parent bodies, which then collisionally evolved to created today's population. A flyby tour of near-Earth and main-belt asteroids is an effective means of quickly sampling many members of this population of objects, providing discovery science on a large number of small worlds in the inner solar system and also returning data that is complementary and contextual to past, present, and future missions. Focusing on family members makes it possible to effectively visit the objects responsible for most of the impactors in the inner solar system and the meteorites that fall to Earth.

The mission we present, the Main-belt Asteroid and NEO Tour with Imaging and Spectroscopy (MANTIS), explores the diversity of asteroids to understand our solar system's past history, its present processes, and future opportunities and hazards. The MANTIS tour visits 15 unexplored asteroids, including an intact planetesimal, a Mars Trojan asteroid, a low-albedo multiple-asteroid system, and members of 8 collisional families. MANTIS addresses many of NASA's highest priorities as laid out in its 2014 Science Plan and provides additional benefit to the Planetary Defense and Human Exploration communities via a low-risk, cost-effective tour of the near-Earth region and inner asteroid belt. MANTIS would revolutionize our understanding of asteroids through its state-of-the-art payload of complementary instruments: A powerful infrared imaging spectrometer and narrow angle camera, both with recent flight heritage, an innovative dust analyzer operating during and between asteroid encounters, and a capable mid-IR imager to help. MANTIS obtains datasets at each target that can be readily intercompared with one another, effectively doubling the current sample of asteroids visited by spacecraft.

We will discuss the MANTIS concept as proposed to the 2019 Discovery competition.